

FINAL TECHNICAL REPORT

Grant Number: NAGW-3644
Principal Investigator: Dr. Marc Postman
Institution: STScI
Project Title: *The HST Guide Star All-Sky Photometric Survey*

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P 2

Overview:

The ST ScI's interest in photographic surveys is driven by the requirement for an all-sky catalog of guide stars to use in pointing the Hubble Space Telescope (HST). Thus, the POSS Quick V and SERC J surveys were digitized and a catalog was constructed by running object detection and classification algorithms on the digitized images (Lasker et al. 1990). Photometric calibration of the HST Guide Star Catalog was essential for guide star verification and acquisition. For this, a photoelectric survey of 1477 fields distributed near the plate centers of the two surveys (583 fields in the north and 894 fields in the south) was undertaken by the ST ScI. The resulting database, known as the Guide Star Photometric Catalog (hereafter GSPC-I; Lasker, Sturch, et al 1988), contains B and V photometry for approximately 10,000 stars in the range $9 < V < 15$ (there are approximately 6 stars per field).

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The plate scanning activity at ST ScI has now been extended to the POSS I/II and AAO R surveys, resulting in a tremendous astronomical resource where, to date, over 2000 Schmidt plates have been digitized and archived. While the GSPC-I is sufficient for providing photometric calibration for objects with $V < 15$, this is well above (about 5 mag) the plate limits of the POSS I/II, SERC J, and AAO R surveys, and fainter reference objects are thus required. The GSPC-I also cannot provide reliable calibration for red passband surveys. Although other facilities have been working with digitized plates for a variety of scientific programs, and some have begun photometric calibration programs of their own (Humphreys et al 1991, Maddox and Sutherland 1992), the GSPC-I still stands today as the only all-sky photometric calibration survey. If the information content of digitized plates is to be fully utilized, for both mission specific and scientific needs, the spectral coverage and limiting magnitude of the GSPC-I has to be expanded.

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STAR ALL-SKY PHOTOMETRIC SURVEY
Final Technical Report (Space
Telescope Science Inst.) 2 p

We began a program to extend the BV photoelectric photometry in the GSPC-I to a fainter V band limit and to add R band data. The new catalog, hereafter GSPC-II, will have 5% photometric accuracy in the V and R passbands to a limiting magnitude of at least $V = 18$. The survey is being conducted using CCD direct imaging cameras at several northern and southern hemisphere sites. The program encompasses the 1477 GSPC-I fields, each one centered on the faintest star in the original GSPC-I sequence.

Below is a summary of what has been accomplished using funds from NAGW-3644.

Data Reduction:

All but a few nights worth of data have now been reduced. This effort has now resulted in good reduced data for at least 500 of the 583 northern fields (and with unreduced data available for 30 additional northern fields). In the south, at least 320 fields have good reduced data including 245 fields out of 486 in the $-30 < \text{dec} < 0$ zone. The bulk of these

fields are from the short exposure survey. Progress on the long exposure survey has recently been accelerated due to the efforts of the staff at Torino Observatory.

Data Acquisition:

We coordinated observations and prepared the required observing lists for 8 NOAO observing runs during course of the grant period. We also coordinated observing priorities for 3 ESO observing runs undertaken by our collaborators at OATo (Torino) in order to maximize efficiency between the CTIO and ESO programs.

Data Analysis:

Software for analyzing GSPC-II data was designed and implemented. This includes programs to compare data of the same object observed on different nights, to compare data of the same object observed at different observatories, and to compare GSPC-II data to GSPC-I data. Such work has been a critical part of establishing the photometric integrity of the survey. Results show we are maintaining the 5% 1 sigma error criteria for all stars brighter than $V = 18$.

We have also developed a prototype photometric calibration pipeline which allows us to compute standard magnitudes for objects on the Digitized Sky Survey, which was recently published on 102 CD ROMs by STScI.

Plans for Publication:

We plan to publish a full description and error analysis of the survey this year. The actual catalog will be distributed electronically via ftp and the World Wide Web. The catalog (approx. 100,000 separate observations) would be updated about two times a year as new data arrive. The ftp catalog would be an ascii flat file with the following information:

Star ID (IAU name convention)	R mag, R mag error, R exposure time
J2000 celestial coordinates	observatory ID, and relevant comments
V mag, V mag error, V exposure time	

We also plan to publish a photometric calibration database for the Digitized Sky Survey on a single CD ROM later this year. This will be distributed to all owners of the DSS and will allow them to compute photometry for objects detected on the plates. The calibration database relies heavily on GSPC-II data and its development has benefited greatly from work done under the present NASA grant.